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LLNL-CONF-417226

Large Optics Diamond Turning Machine (LODTM)

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Disclaimer

Lawrence Livermore National Laboratory

Large Optics Diamond Turning Machine (LODTM)

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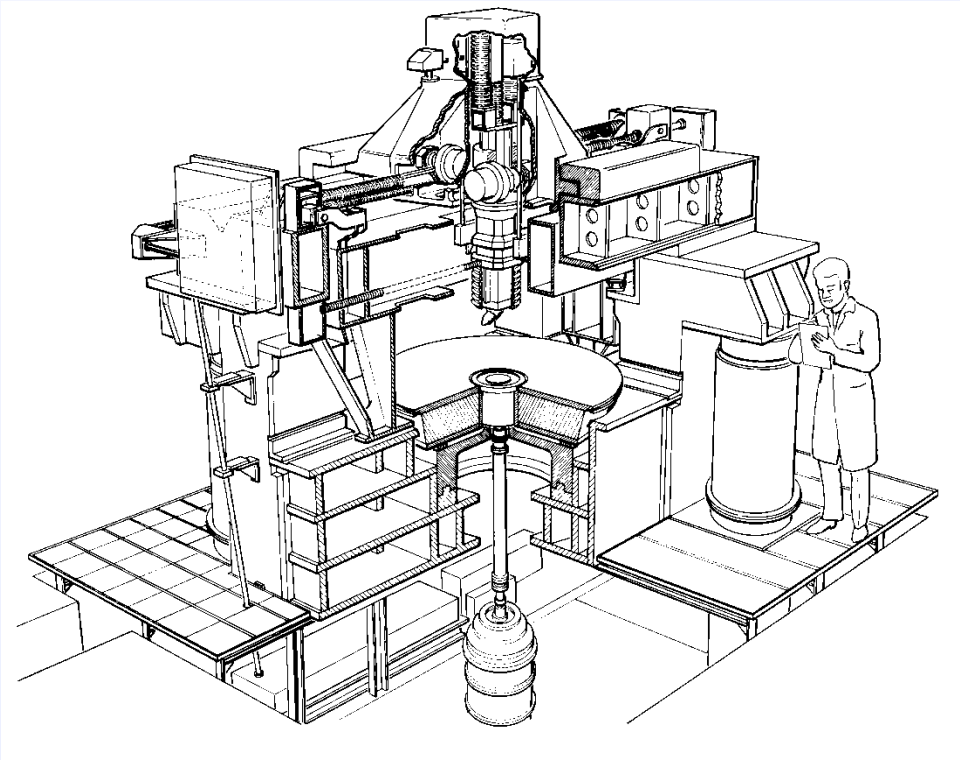
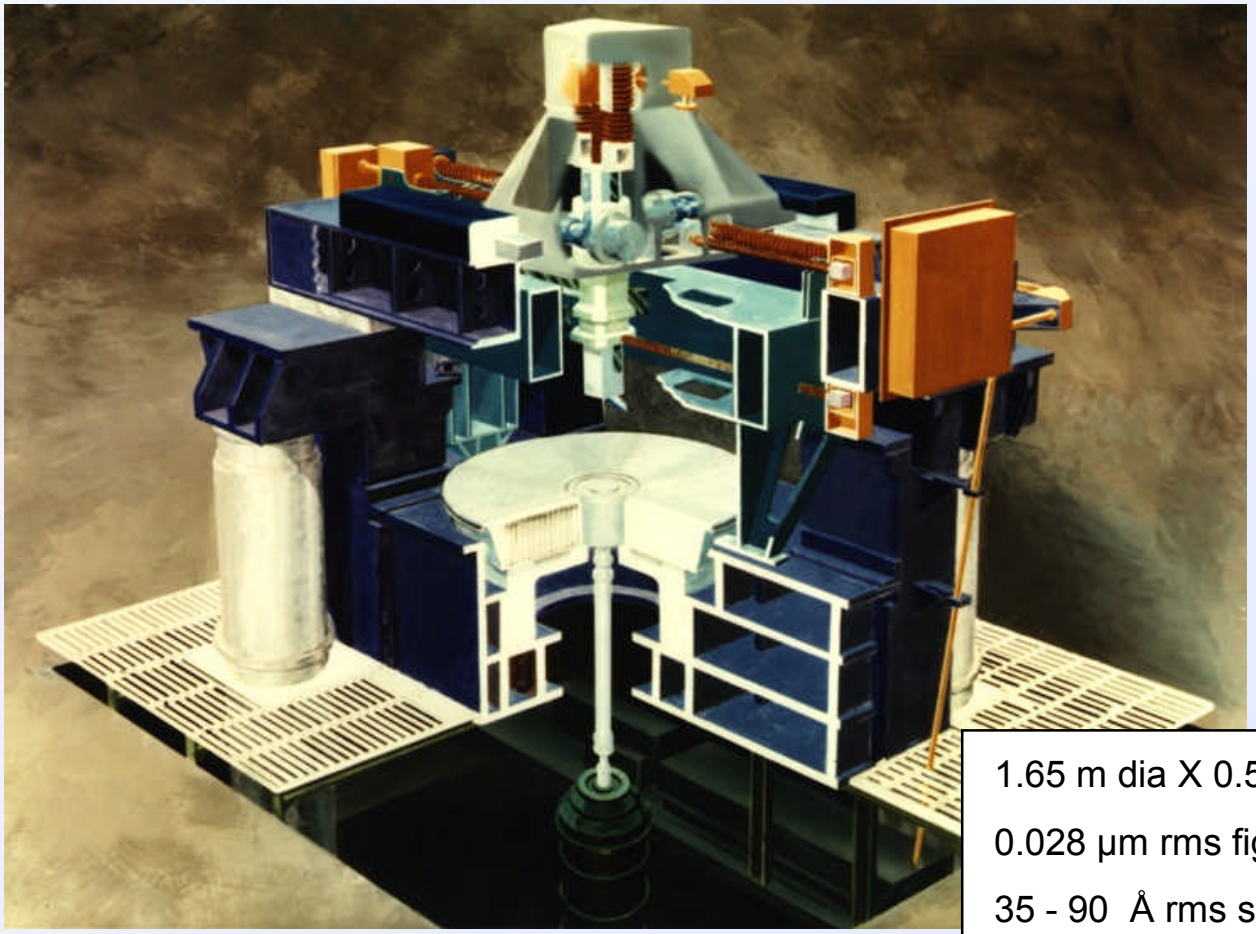
Large Optics Diamond Turning Machine (LODTM)



Technologies utilized by LODTM to achieve ALPHA quality SPDT

- super invar metrology frame
- precision temperature stabilization of metrology frame (water jacket around metrology frame with 100 gallons/min at ±1/2 m°F over 24 hours)
- precision temperature air shower over LODTM (18,000 CFM at ±5 m°F over 24 hours)
- capstan direct drive using dc servo actuators
- spindle motion compensation in real-time (1.5 ms update)
- straightness and squareness error correction in real-time (1.5 ms update)
- multiple sensors (7 laser interferometers, 4 differential cap. gauges, 1 encoder) used to compute tool-to-part X/Z coordinates in real-time (1.5 ms update)
- evacuated interferometer beam paths

LODTM provided the highest accuracy in precision turning and dimensional metrology for its meter size capacity

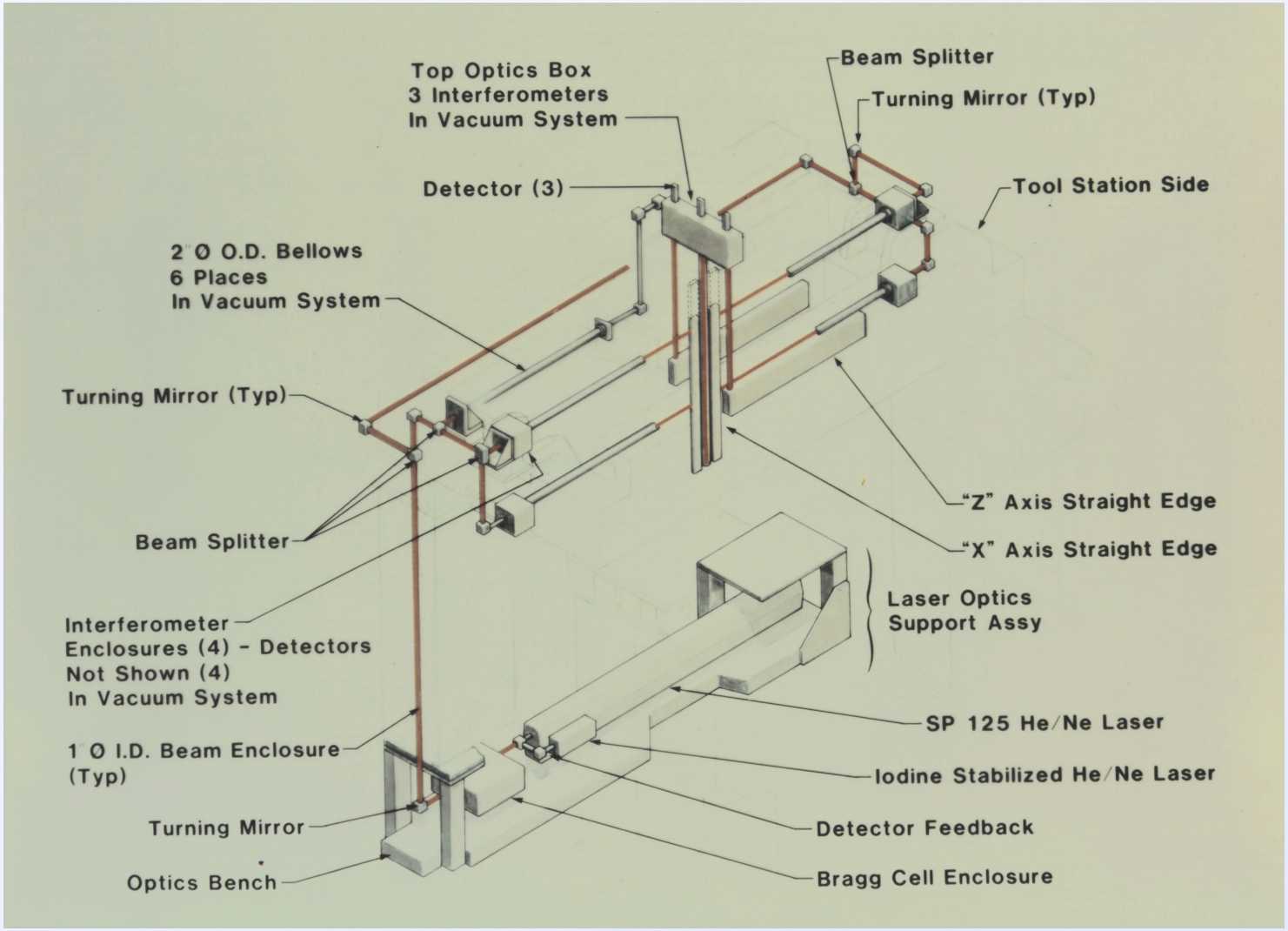


1.65 m dia X 0.5 m work zone

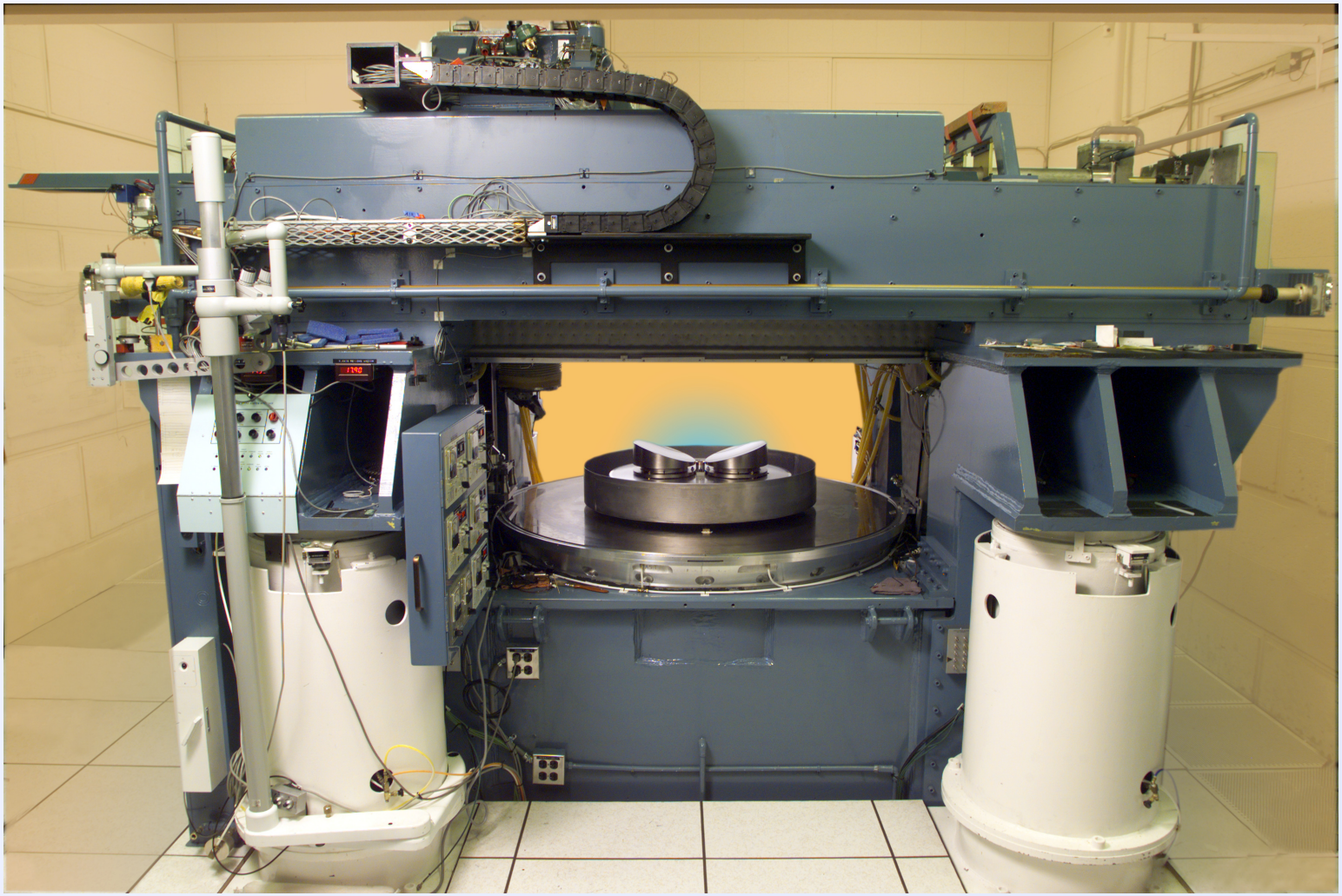
0.028 μm rms figure accuracy

35 - 90 Å rms surface finish

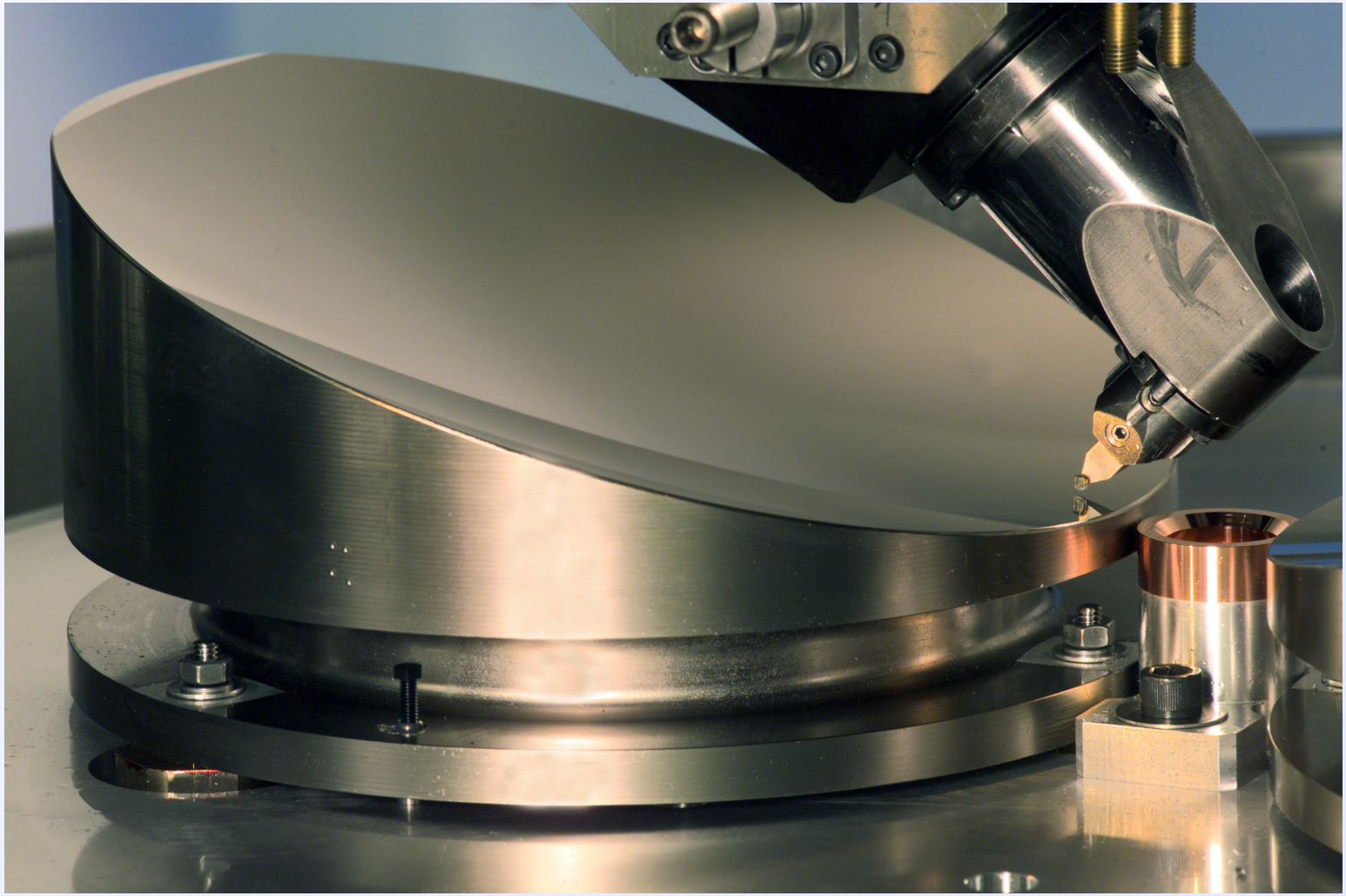
LODTM "X" & "Z" Laser Metrology Frame



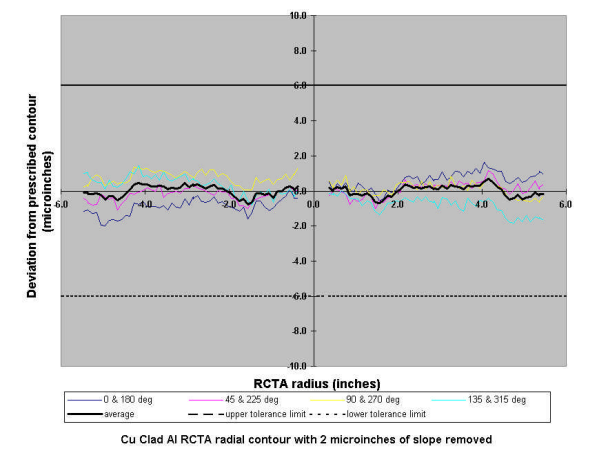
LODTM Preparation for Off Axis Morrors



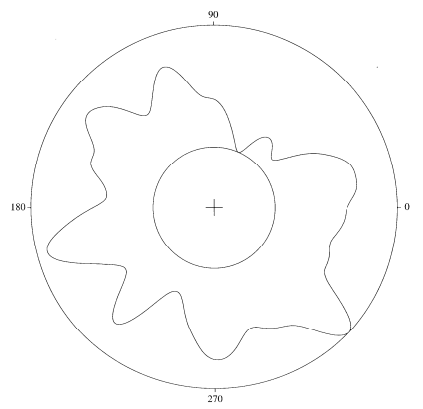
LODTM Diamond Machining an Off Axis Mirror



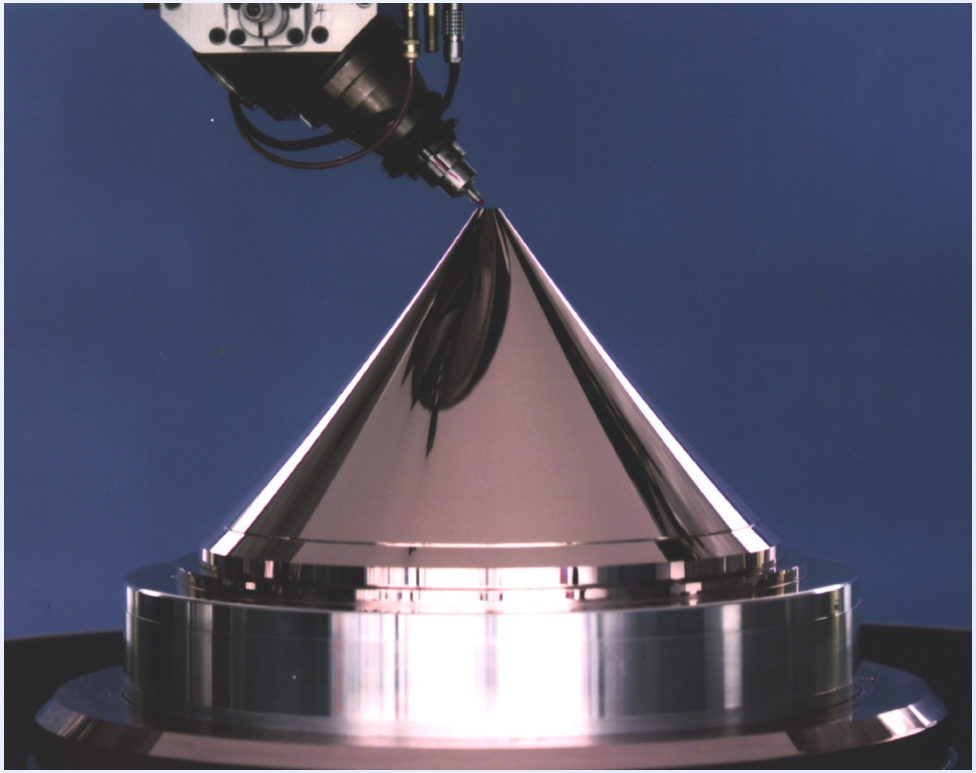
LODTM Diamond Turned & Inspected a Cu-clad RCTA to ALPHA Quality



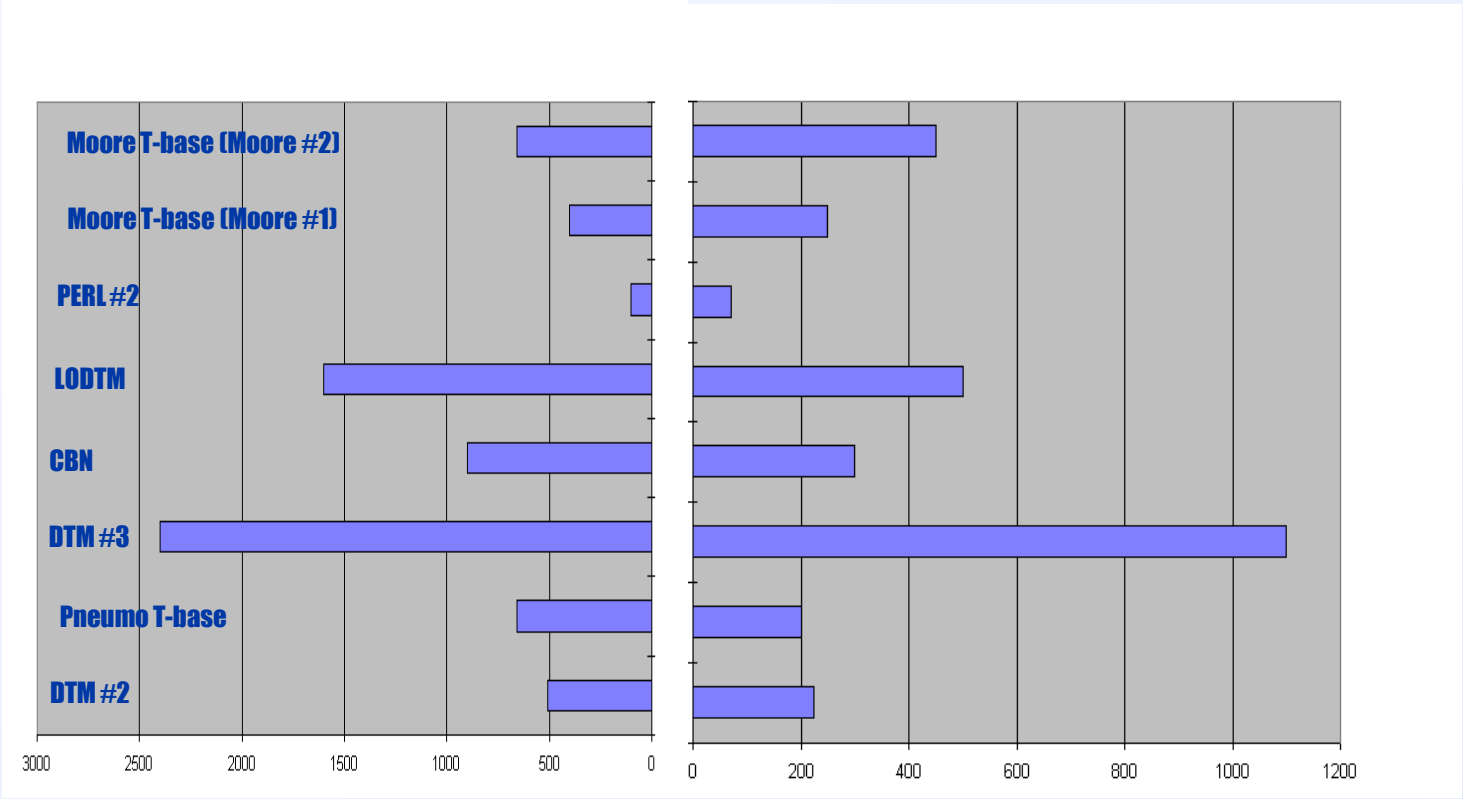
Cu Clad Al RCTA radial contour with 2 microinches of slope removed



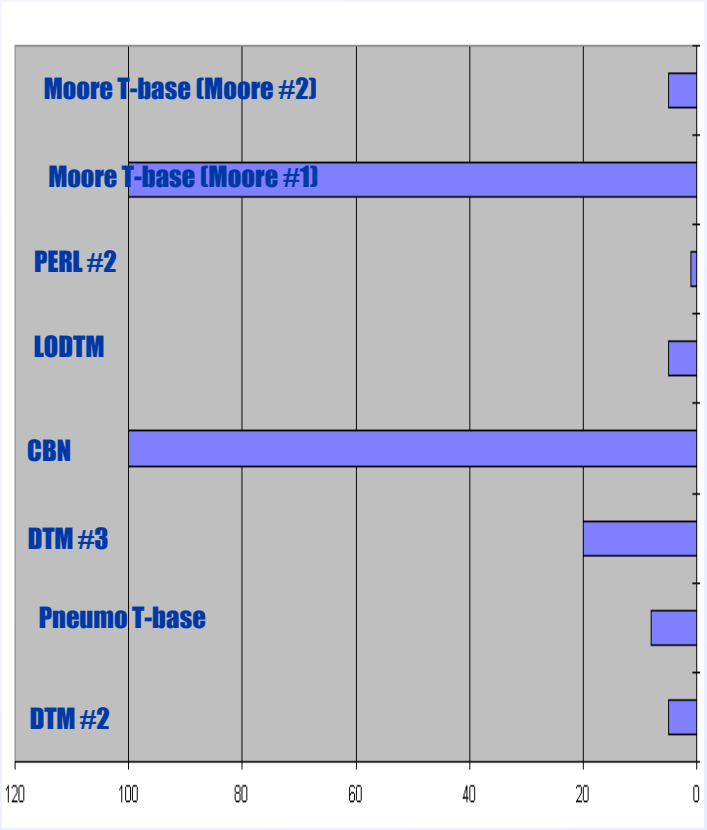
Span from inner to outer circle = 1.1 µinches
Date: 17-September-1998
Centering: Not centered
Filtering: 41.7 UPR



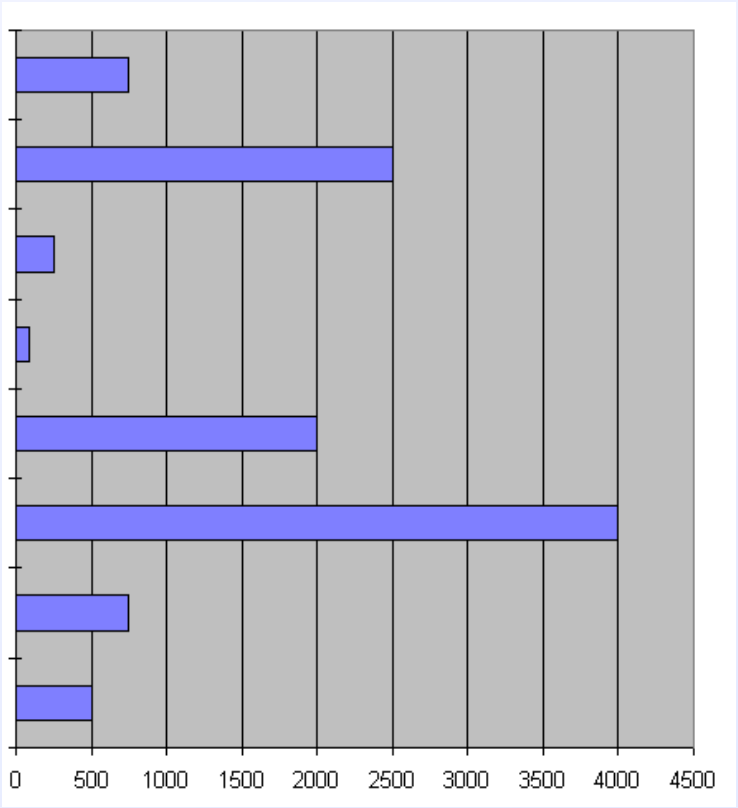
Working volumes for selected LLNL diamond turning machines



Typical contour and surface finish on copper parts for selected LLNL diamond turning machines



Surface Roughness in nm RMS



Contour Accuracy in nm peak-to-valley